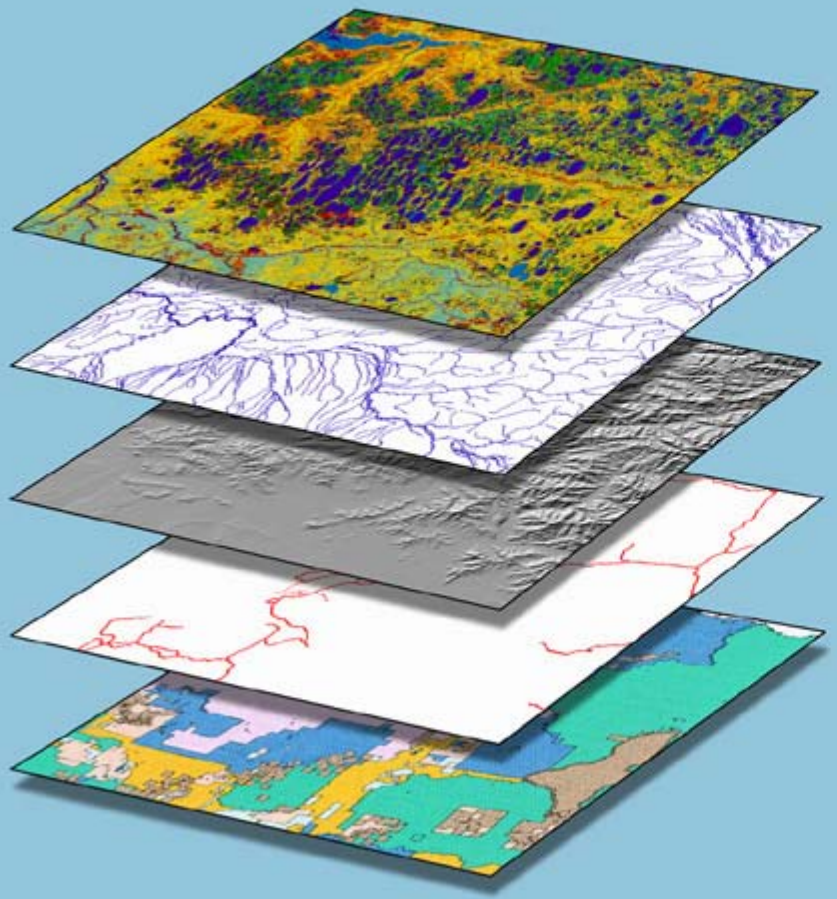
Alaska Earthcover Mapping

History of Earth Cover Mapping in Alaska

- late 1980's with Ducks Unlimited, Canada
- 1992 begin long-range outlook
- 1997 five-year plan
- 2005 over 151 million acres completed and more in progress.
- Earth Cover Classification System has approval of Alaska Geographic Data Committee and is being used in Canada, circumpolar arctic and Ukraine, accepted by 26 agencies, NGOs and conservation groups.

Basic Layers Within a Functional GIS



Earthcover

Hydrography

Digital Elevation Model

Transportation

Land Status

Why Alaska is Different!

- Large remote land base
- Limited dollars to gather traditional information on vegetation, soils, water, etc.
- Needed cost effective methodology
- Landscape level information for wildlife, subsistence, recreation, development, etc.
- Integration with other digital data
- Landscape level fire management

What We do!

- Ducks Unlimited and BLM developed a standardized approach to earth cover that was adopted by Alaska Geographic Data Committee and other agencies.
- Intensive field effort to collect training and accuracy assessment sites, **essential for final map products.**
- Continuing refinement of the technology for processing Landsat TM (30 meter).
- Each acre is now about $ 0.05-.08!!!

ALASKA EARTH COVER CLASSIFICATION

FIELD WORK AND PROCESSING

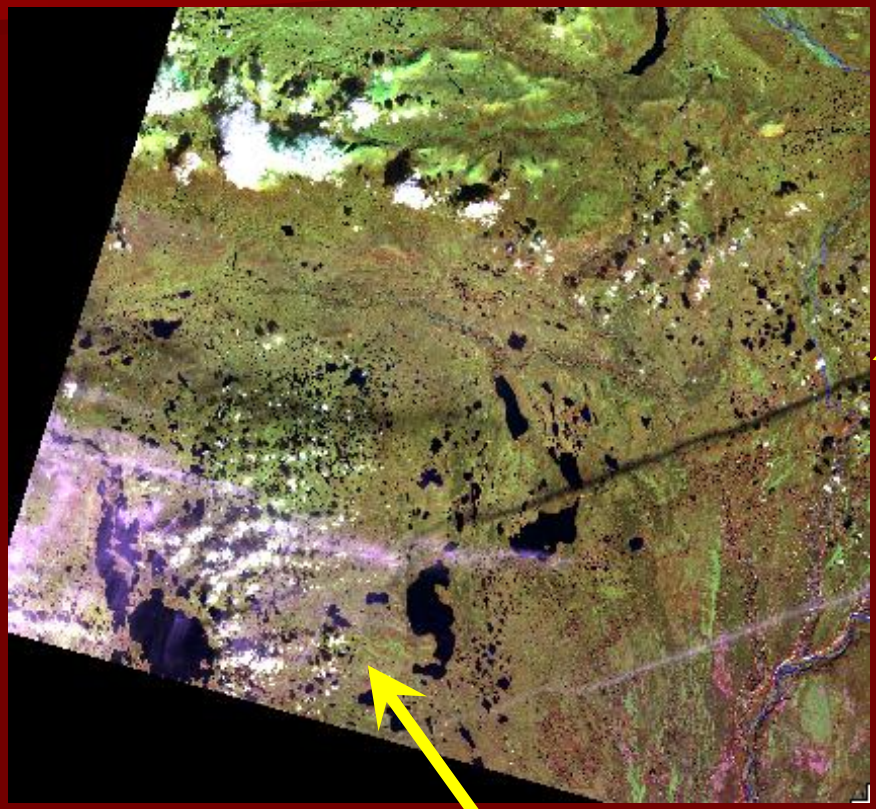
PRE-FIELD WORK

- Image Pre-processing, selection of imagery, selection of training sites.
- Planning and Field Logistics

Image Pre-Processing

- Image selection/ordering
- QA/QC imagery
- Remove clouds from images
- Select field sites
- Produce plots of images with field sites

QC Imagery and Remove Clouds

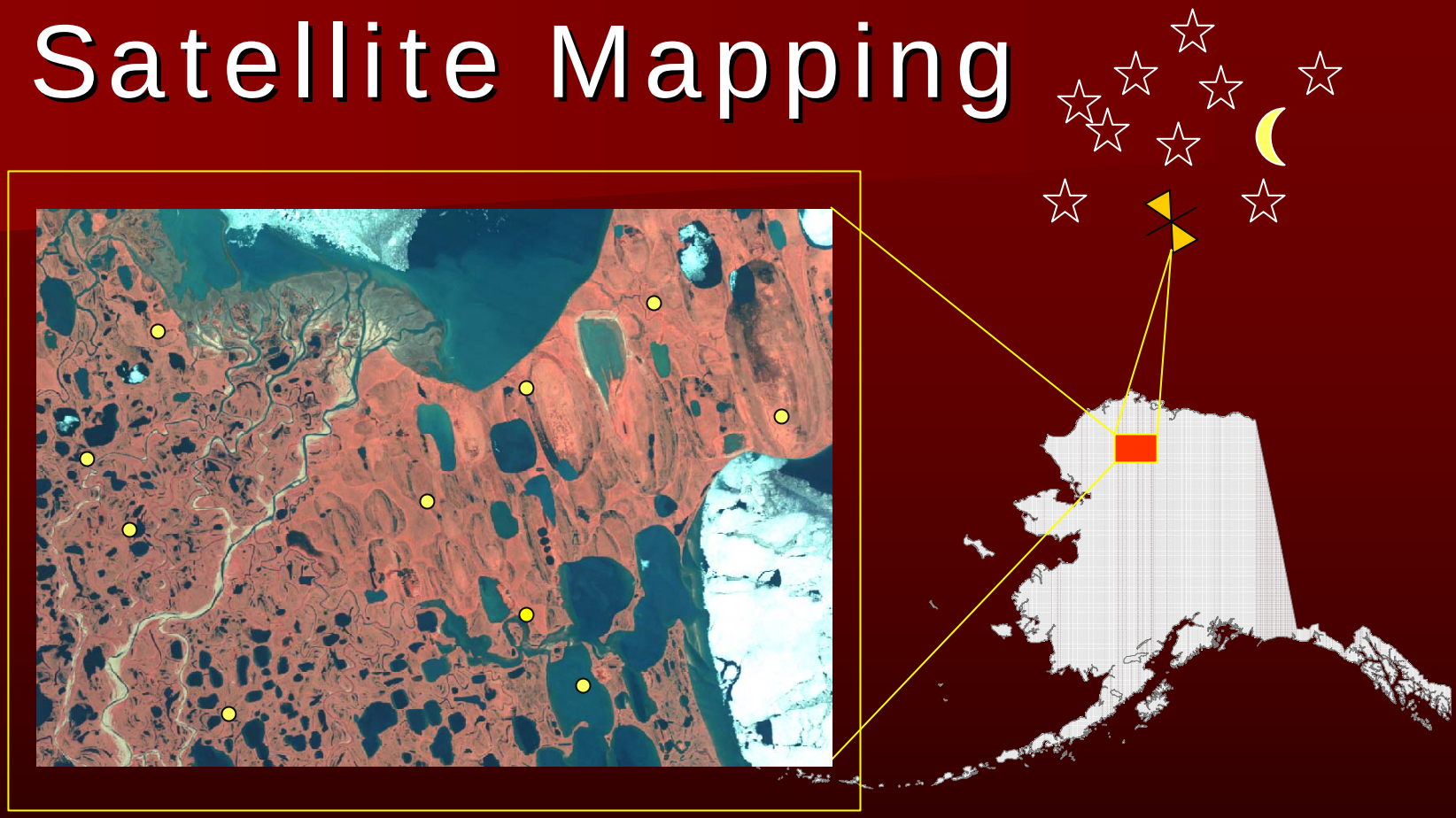


Shadows

Bad Pixels

Clouds/Haze

Satellite Mapping

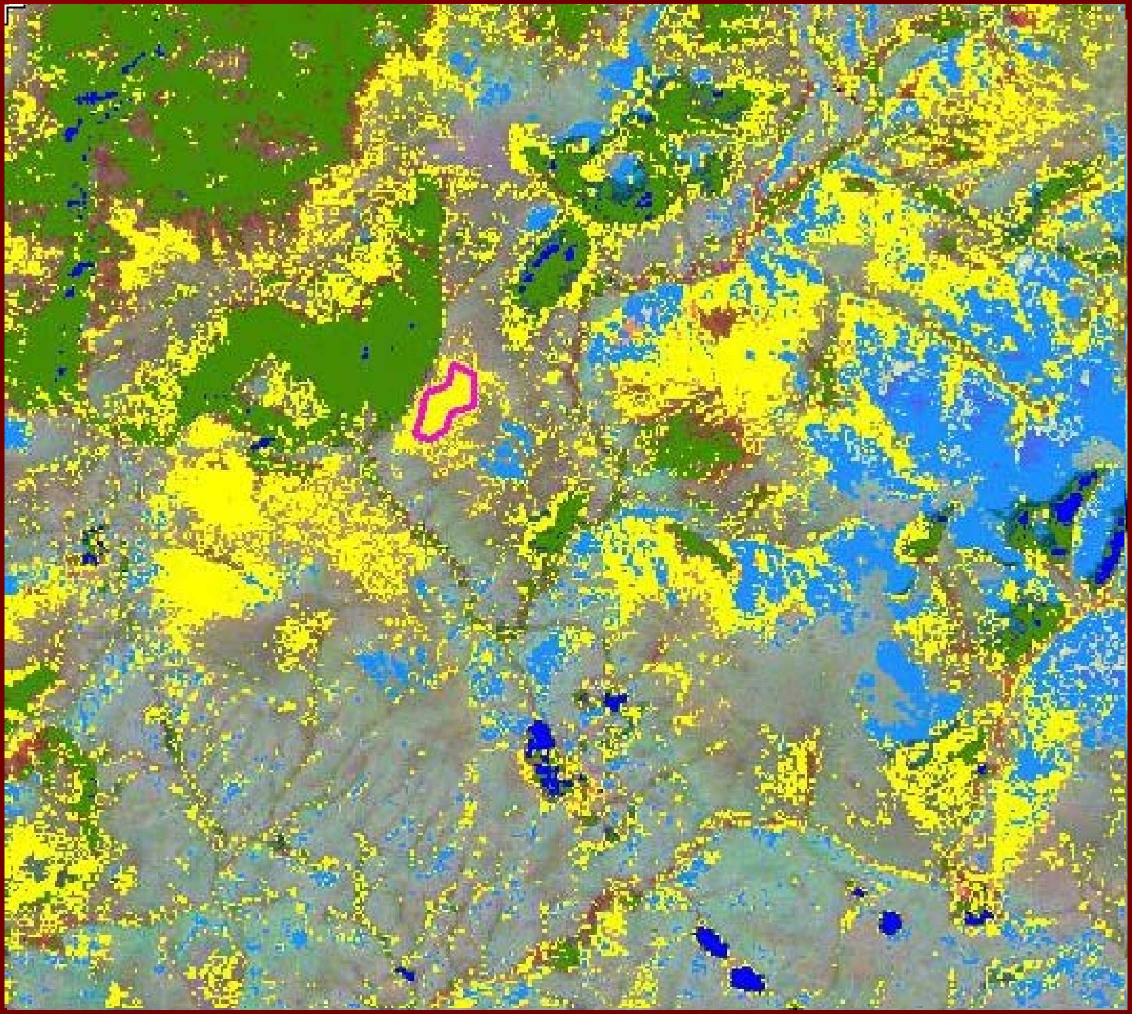


- Light reflected by vegetation
- Statistically isolate groups or “classes”

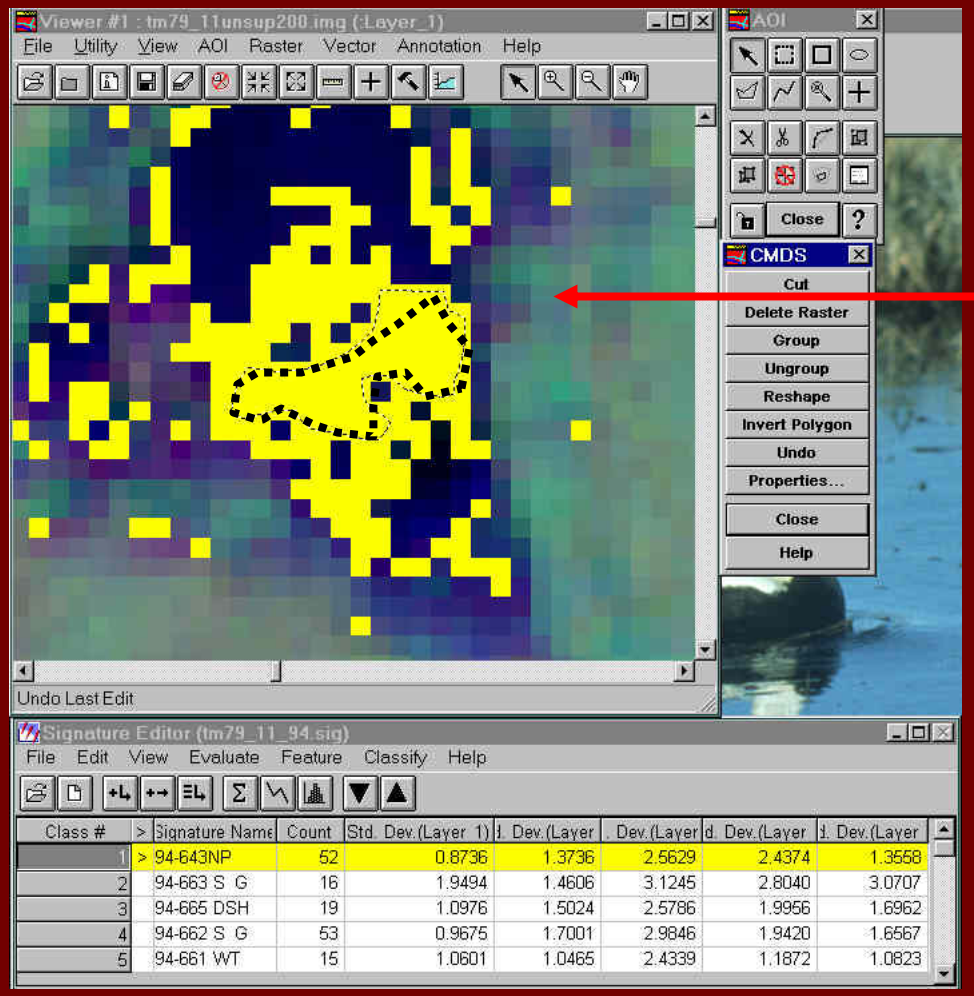
Select Field Sites

Select field sites from supervised classification representing the range of spectral variation across the image

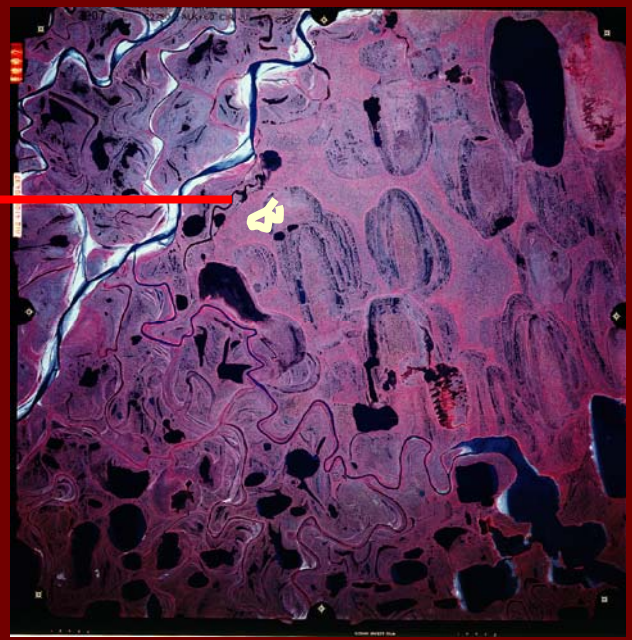
An unsupervised 30 class classification groups spectrally similar areas



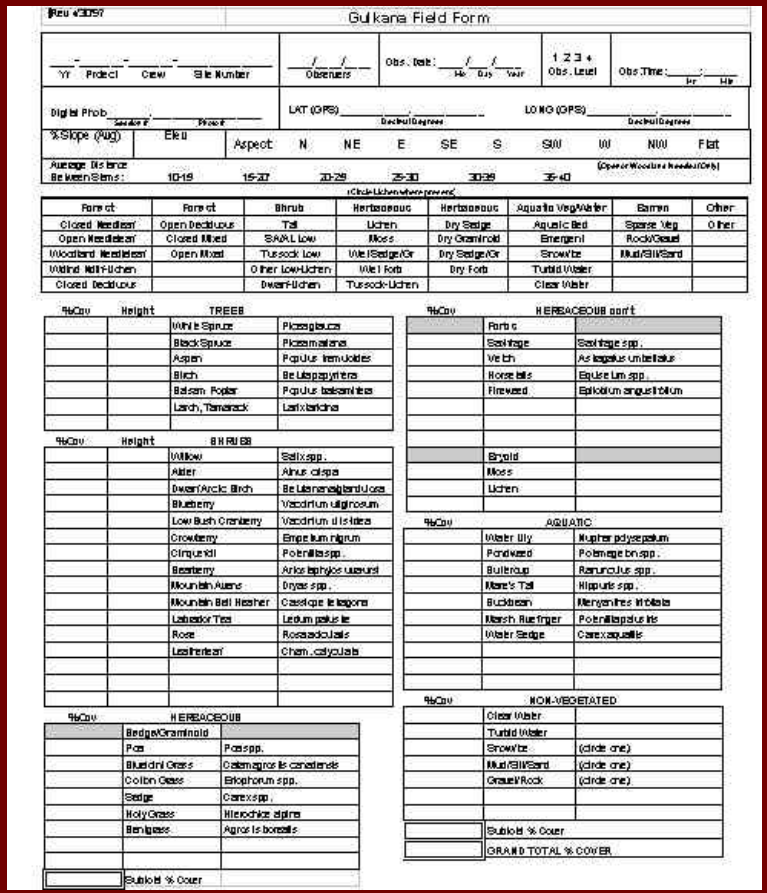
Select Field Sites



Class #	>	Signature Name	Count	Std. Dev.(Layer 1)	d. Dev.(Layer	Dev.(Layer	d. Dev.(Layer	d. Dev.(Layer
1	>	94-643NP	52	0.8736	1.3736	2.5629	2.4374	1.3558
2		94-663 S G	16	1.9494	1.4606	3.1245	2.8040	3.0707
3		94-665 DSH	19	1.0976	1.5024	2.5786	1.9956	1.6962
4		94-662 S G	53	0.9675	1.7001	2.9846	1.9420	1.6567
5		94-661 WT	15	1.0601	1.0465	2.4339	1.1872	1.0823



Plot Field Maps and Field Forms



Gulkana Field Form

Yr	Project	Crew	Site Number	Observers	Obs. Date: Mo Day Year	Obs. Level 1 2 3 4	Obs. Time: Hr Min

Digital Photo: Sequence # Photo #

LAT (GPS) Decimal Degrees LONG (GPS) Decimal Degrees

%Slope (Avg)	Elev	Aspect: N NE E SE S SW W NW Flat

Average Distance Between Stems: 10-14 15-20 20-25 25-30 30-35 35-40 (Open or Woodland Needle Only)

(Circle Lichen where present)

Forest	Forest	Shrub	Herbaceous	Herbaceous	Aquatic Veg/Water	Barren	Other
Closed Needlel	Open Deciduous	Tall	Lichen	Dry Sedge	Aquatic Bed	Sparse Veg	Other
Open Needlelea	Closed Mixed	SHRUL Low	Moss	Dry Graminoid	Emergent	Rock/Gravel	
Woodland Needlelea	Open Mixed	Tussock Low	Wet Sedge/Gr	Dry Sedge/Gr	Snow/Ice	Mud/Silt/Sand	
Wdlnd Mxd Lichen		Other Low-Lichen	Wet Forb	Dry Forb	Turbid Water		
Closed Deciduous		Dwarf-Lichen	Tussock-Lichen		Clear Water		

%Cov	Height	TREES	
		White Spruce	Picea glauca
		Black Spruce	Picea mariana
		Aspen	Populus tremuloides
		Birch	Betula papyrifera
		Balsam Poplar	Populus balsamifera
		Larch, Tamarack	Larix laricina

%Cov	Height	SHRUBS	
		Willow	Salix spp.
		Alder	Alnus crispa
		Dwarf Arctic Birch	Betula nana/glandulosa
		Blueberry	Vaccinium uliginosum
		Low Bush Cranberry	Vaccinium vitis-idea
		Crowberry	Empetrum nigrum
		Cinquefoil	Potentilla spp.
		Bearberry	Arctostaphylos uva-ursi
		Mountain Avens	Dryas spp.
		Mountain Bell Heather	Cassiope tetragona
		Labrador Tea	Ledum palustre
		Rose	Rosa acicularis
		Leatherleaf	Chem. calyculata

%Cov	HERBACEOUS	
	Sedge/Graminoid	
	Poa	Poa spp.
	Bluejoint Grass	Calamagrostis canadensis
	Cotton Grass	Eriophorum spp.
	Sedge	Carex spp.
	Holy Grass	Hierochloe alpina
	Bentgrass	Agrostis borealis
	Subtotal % Cover	

%Cov	HERBACEOUS cont'd	
	Forbs	
	Saxifrage	Saxifraga spp.
	Vetch	Astragalus umbellatus
	Horsetails	Equisetum spp.
	Fireweed	Epilobium angustifolium
	Bryoid	
	Moss	
	Lichen	

%Cov	AQUATIC	
	Water lily	Nuphar polysepalum
	Pondweed	Potamogeton spp.
	Buttercup	Ranunculus spp.
	Mare's Tail	Hippuris spp.
	Buckbean	Menyanthes trifoliata
	Marsh Fleefinger	Potentilla palustris
	Water Sedge	Carex aquatilis

%Cov	NON-VEGETATED	
	Clear Water	
	Turbid Water	
	Snow/Ice	(circle one)
	Mud/Silt/Sand	(circle one)
	Gravel/Rock	(circle one)
	Subtotal % Cover	
	GRAND TOTAL % COVER	

Customized data collection form

Pre-selected field sites

Field Work Planning

- Designate field crews
- Procurement of Aircraft
- Determine field camp locations
- Determine optimal sites for fuel locations
- Determine amount of fuel needed

Field Planning Map

FIELD CREW

Navigator: Dan
Recorder: Lori
Vegetation Caller: Scott
Alternate: Mike

Fuel

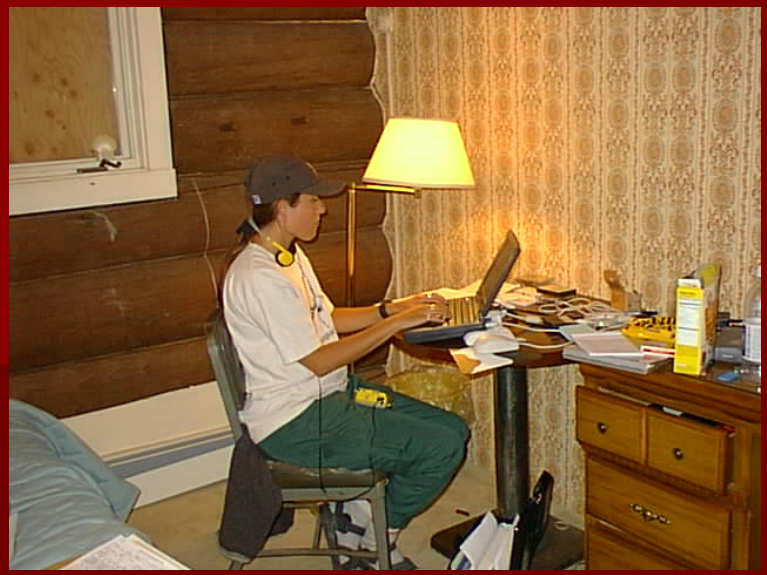
Tiekel 500 gal.
Glennallen 1000 gal.

FIELD WORK

Crew Roles/Responsibilities

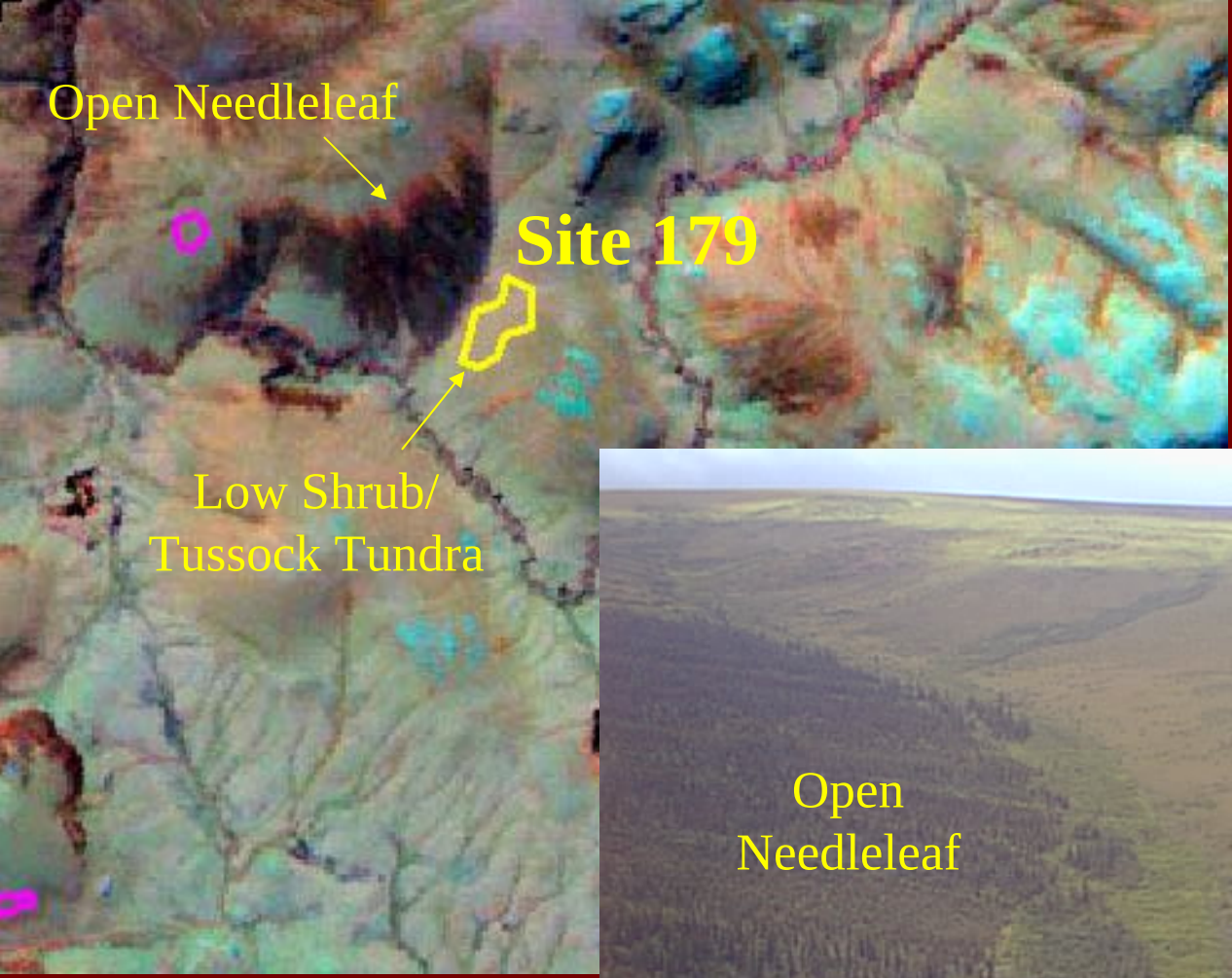
Vegetation Caller

Navigator/Image Processor

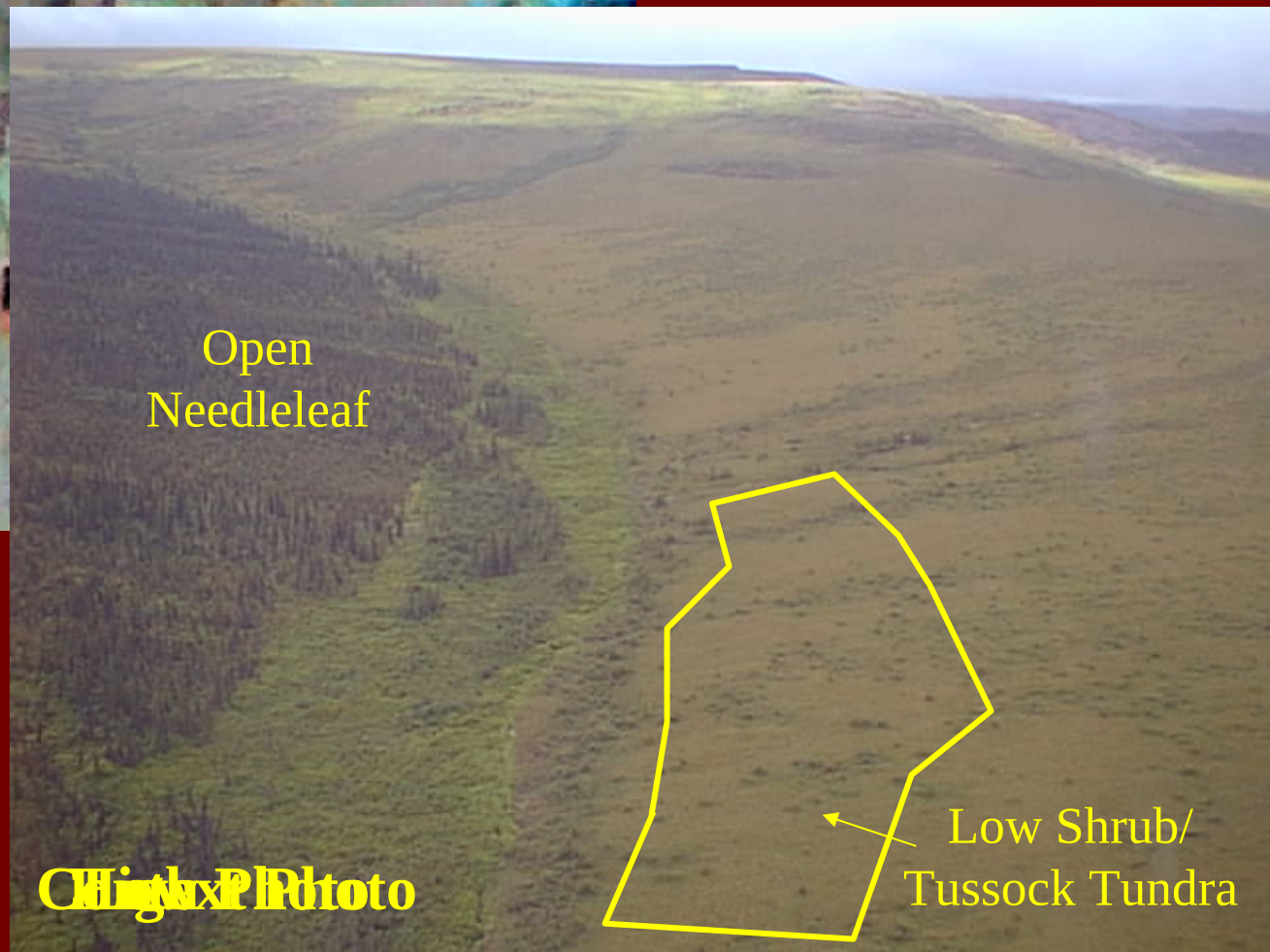


Crew Roles/Responsibilities

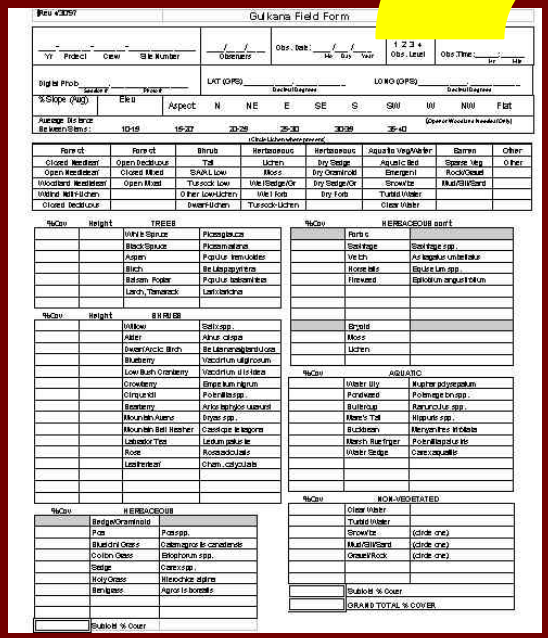
Recorder/Alternate



Field Data Collection



Field Form input into DUFF Database


Gukana Field Form

Ducks Unlimited

File Tools Help

1997 BR 99
Year Project Site
(click to search) Delete New

Observation Crew
Nav Veg Rec
DF SG JH

Check Flag (military)
Observ Date 09-Aug-97
Obs Level 2
Obs Time 12:49

Update

Session
1 -> 2
1 -> 1

Photo

Lat (degrees, decimal min) 00d00.00000
Long 000d00.0000
% Slope 12
Elev 0.
Aspect NE
Avg Dist Btwn Stem

All Species Latin Common Show All Species
Add... Delete Edit...

Observed Classes
- FOREST- CLOSED NEEDLELEAF
- FOREST- OPEN NEEDLELEAF
- FOREST- WOODLAND NEEDLELEAF
- FOREST- WOODLND NDLLF-LICHEN
- FOREST- CLOSED DECIDUOUS
- FOREST- OPEN DECIDUOUS
- FOREST- CLOSED MIXED
- FOREST- OPEN MIXED
- SHRUB- TALL
- SHRUB- SA/AL LOW
- SHRUB- TUSSOCK LOW
- SHRUB- OTHER LOW-LICHEN
- SHRUB- DWARF-LICHEN
- HERBACEOUS- LICHEN
- HERBACEOUS- MOSS
- HERBACEOUS- WET DEDGE/GR
- HERBACEOUS- WET FORB
- ☑ HERBACEOUS- TUSSOCK-LICHEN

Observed Species

Symbol	Latin	Common	% Cov	Height
CAXX	CAREX SPP	SEDGE SPP	10	
MOXX	MOSS	MOSS	20	
LIXX	LICHEN	LICHEN	0	
LITT	LITTER	LITTER	0	
SAX_	SALIX SPP	WILLOW	0	
BEGL	BETULA GLANDULOSA	BIRCH,DWARF ARCTIC	14	0.2
VAUL	VACCINIUM ULIGINOSUM	BLUEBERRY,BOG	0	0.
VAV	VACCINIUM VITIS-IDAEA	CRANBERRY MOUNTAIN	0	

Comments
OBSERVED CLASS: NO LICHEN

Sum of % Covers : 100

Calculated Class 3.35 MESIC/DRY FORB

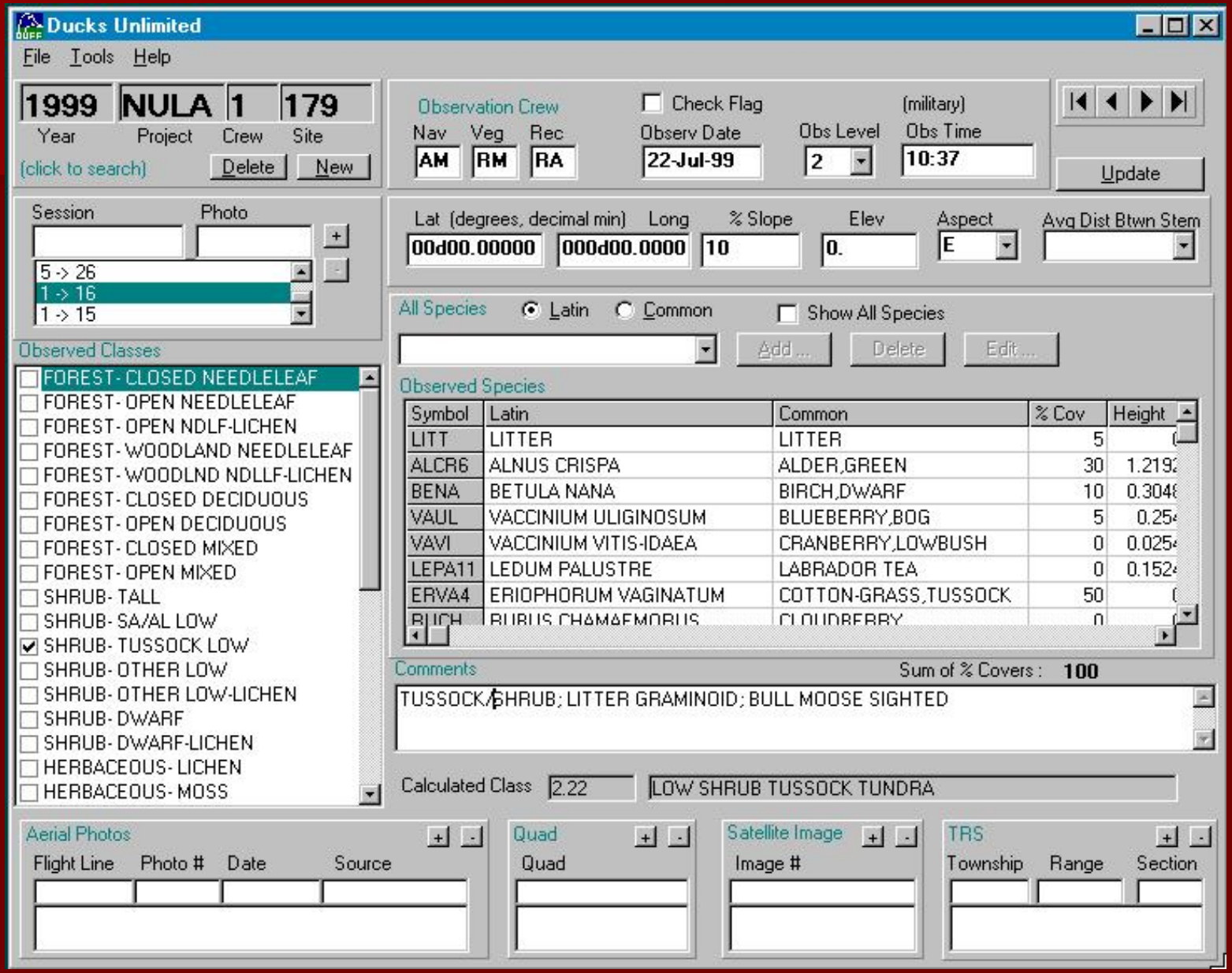
Aerial Photos
Flight Line Photo # Date Source

Quad
Quad

Satellite Image
Image #

TRS
Township Range Section

DUFF Data Entry Application



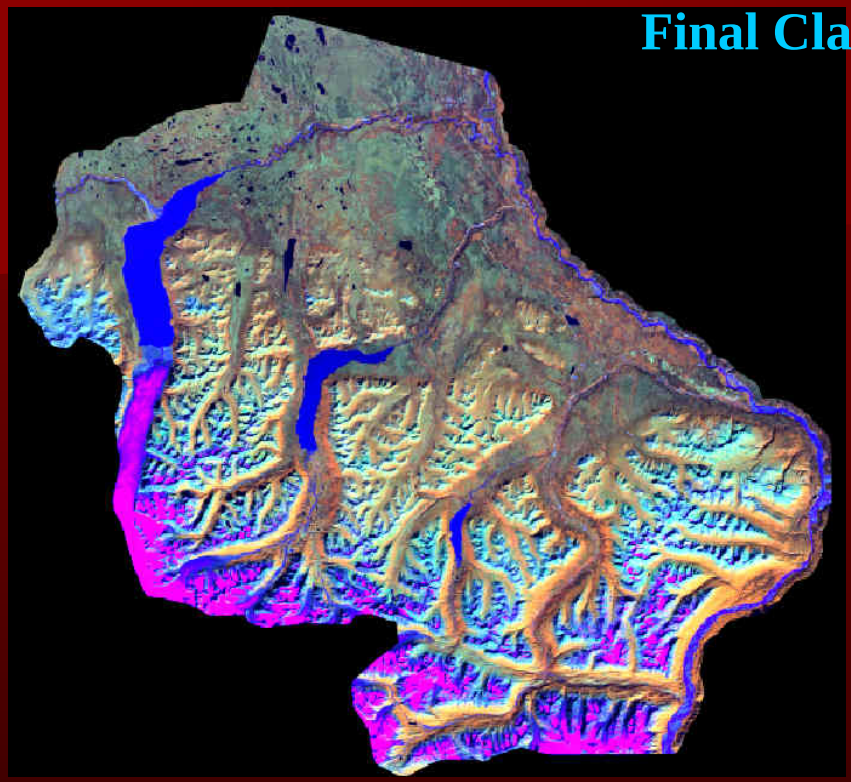
POST-FIELD WORK

- Field Site Database Quality Check
- Digitize New Field Sites
- Separate Accuracy Assessment Sites
- Classification
- Mosaic With Adjacent Classifications
- Final Products

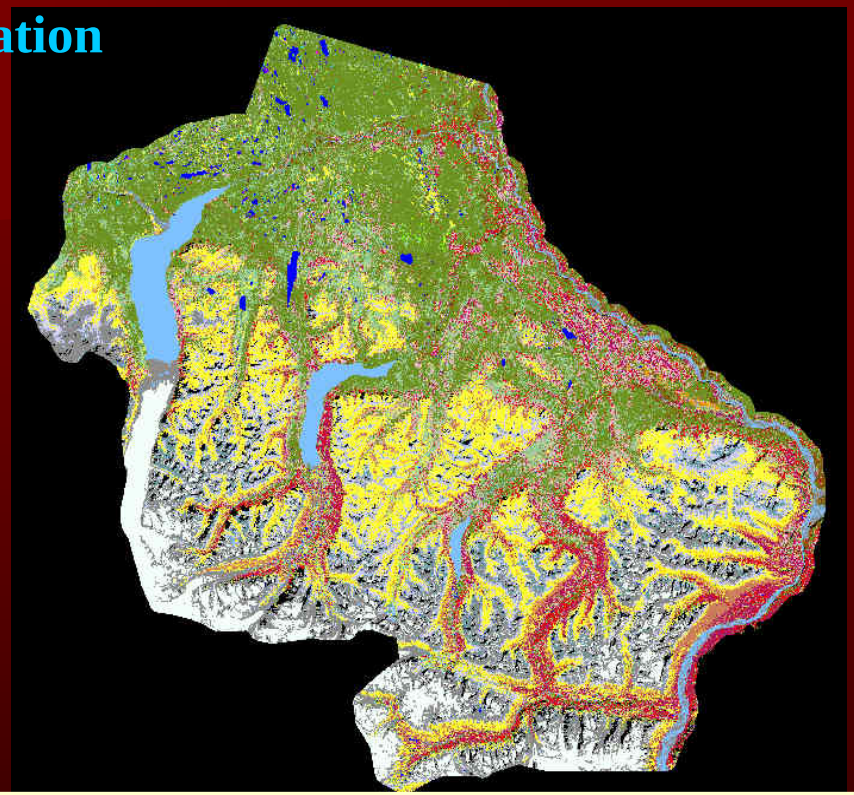
Supervised Classification

TIEKEL PROJECT

Final Classification



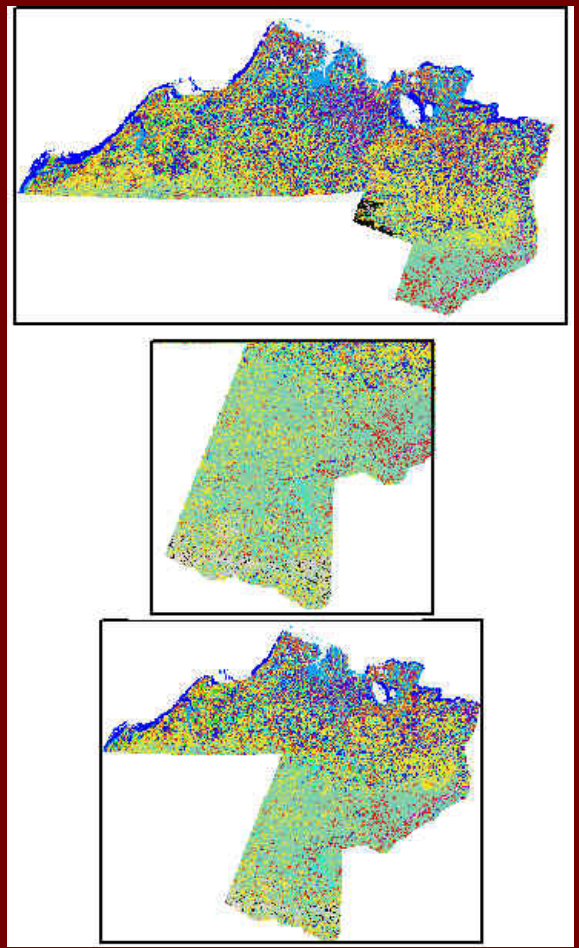
Landsat TM Image



Classified Map

- Closed Needleleaf
- Open Needleleaf
- Woodland Needleleaf
- Closed Deciduous
- Open Deciduous
- Closed Mixed Ndl./Dec.
- Open Mixed Ndl./Dec.
- Tall shrub
- Low Shrub
- Dwarf Shrub
- Wet Graminoid
- Aquatic Bed
- Emergent Vegetation
- Clear Water
- Turbid Water.
- Ice/Snow
- Rock/Gravel
- Sparse Vegetation
- Agriculture
- Terrain Shadow

Mosaic Classifications



Existing Classification

+

New Classification

Mosaic

DUFF Information

Crew Number: 1
Site Area: 116169.72230
Navigator: RS
Accuracy Assessment: Training
Area Name: KARH
Perimeter: 1361.22269
Veg. Observer: SN
Observation Date (YYYYMMDD): 19980722
Site ID: 2023
Recorder: RL
Observation level: 2

Lat. 66.42683 Long: -151.82697 % Slope: 0 Elev. 544 Aspect: Flat Stem dist: N/A

Observed Class: EMERGENT
Observed ID: 24
Calculated Class: EMERGENT VEGETATION
Calculated ID: 24.000
Major Observered Class: AQUATIC VEG/WATER

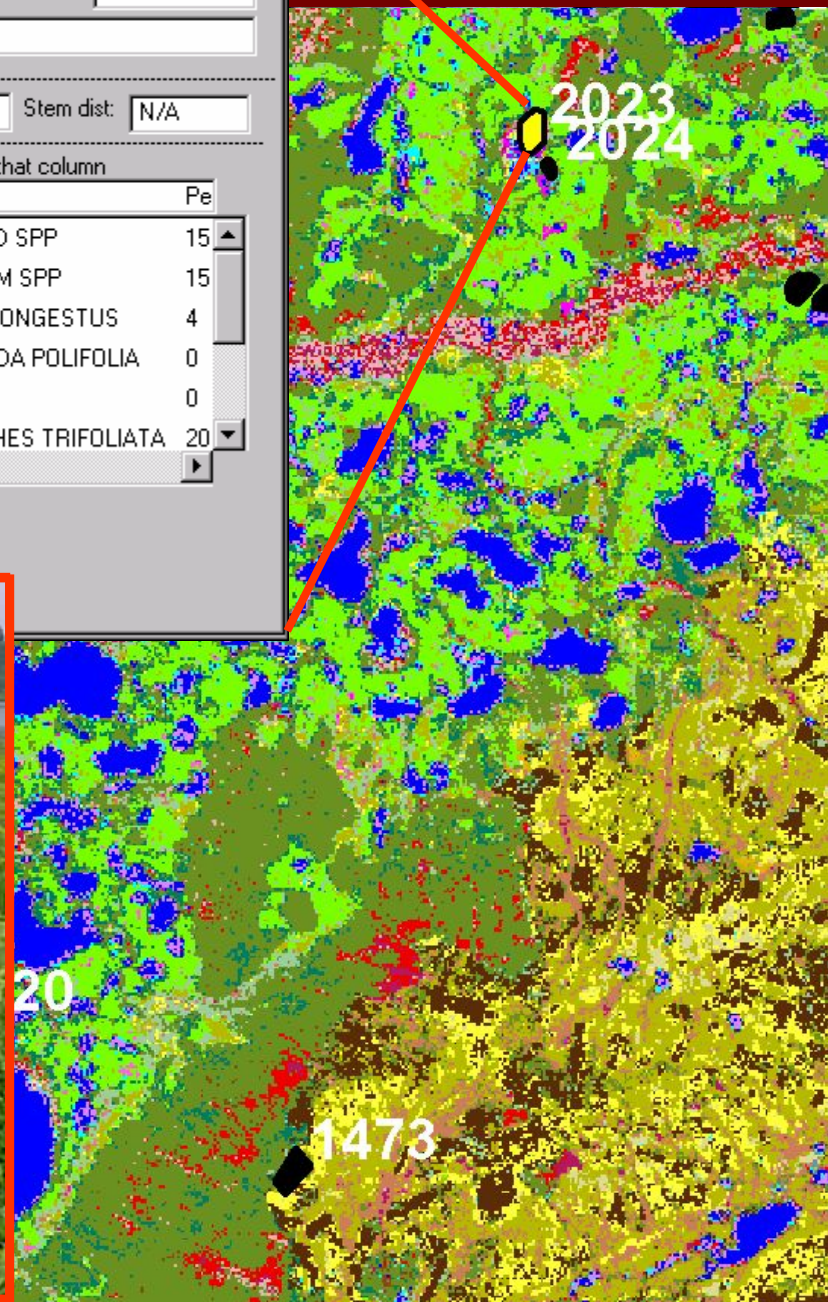
Comments:

Note: Coordinates given are in Lat./Long.

Click on the first value in a column to sort by that column

Common	Species	Pe
GRAMINOID SPP	GRAMINOID SPP	15
HORSETAILS SPP	EQUISETUM SPP	15
GROUNDSEL,MARSH	SENECIO CONGESTUS	4
ROSEMARY,BOG	ANDROMEDA POLIFOLIA	0
MOSS	MOSS	0
BUCKBEAN	MENYANTHES TRIFOLIATA	20

Close



ALASKA EARTH COVER INITIATIVE

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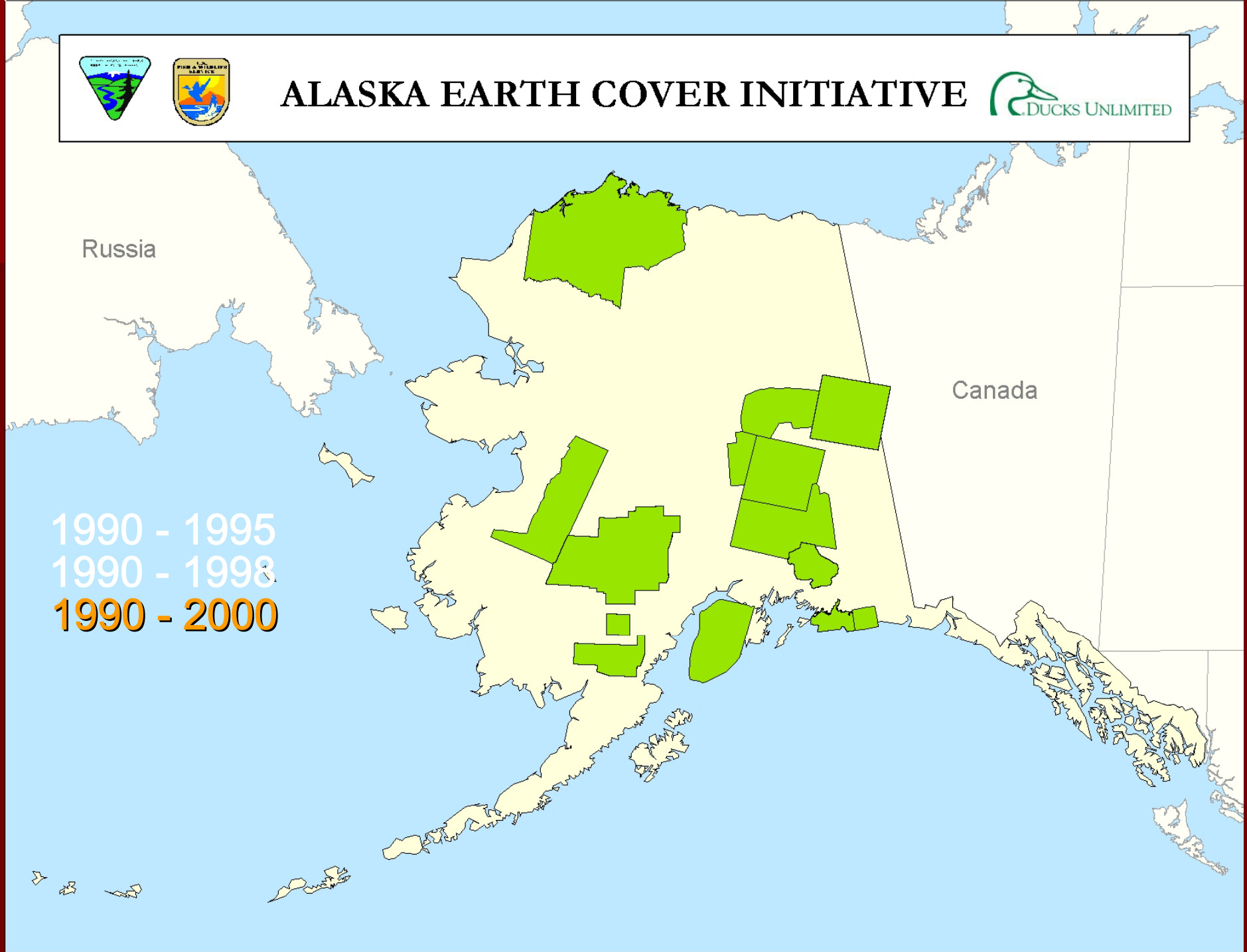

ALASKA EARTH COVER INITIATIVE

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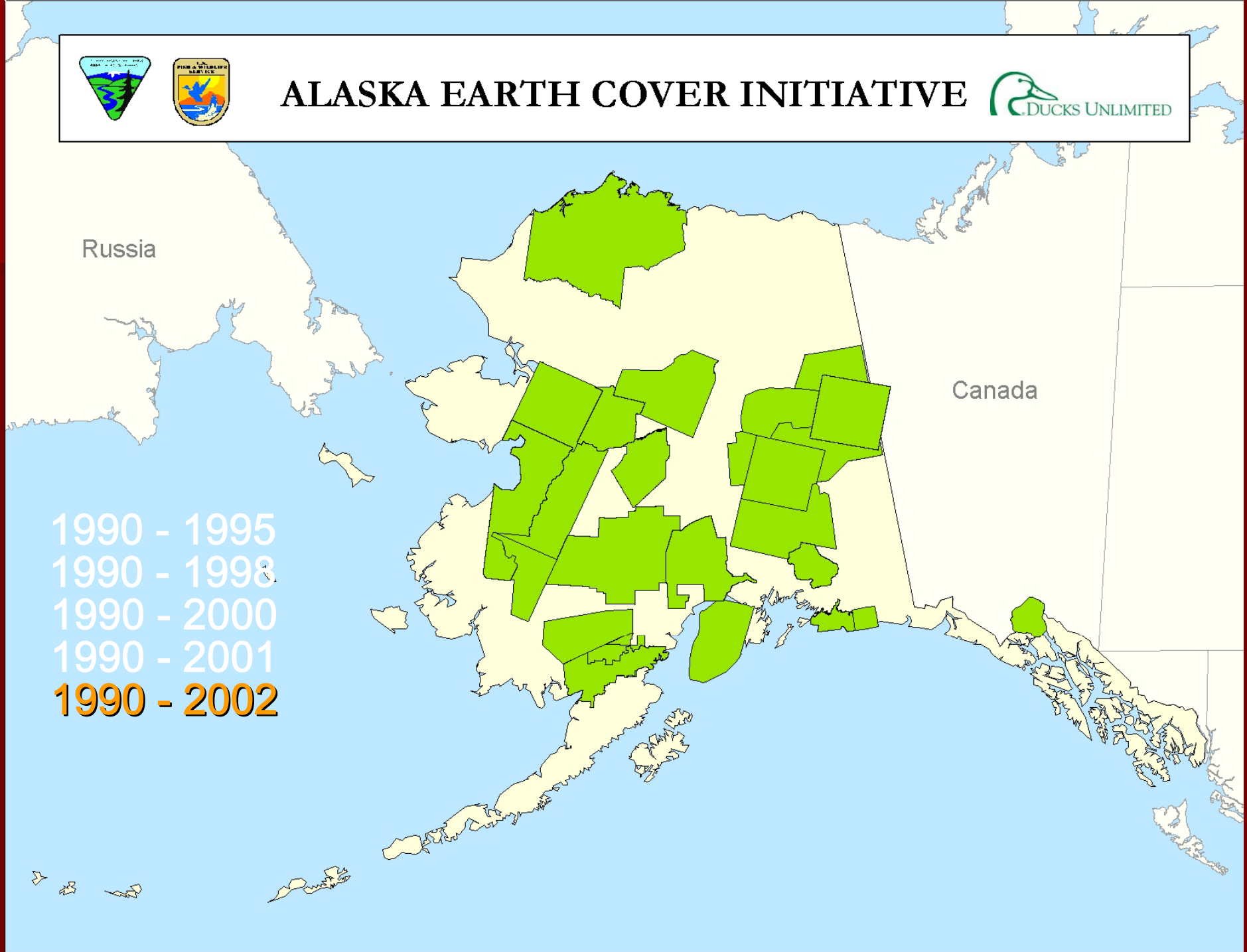
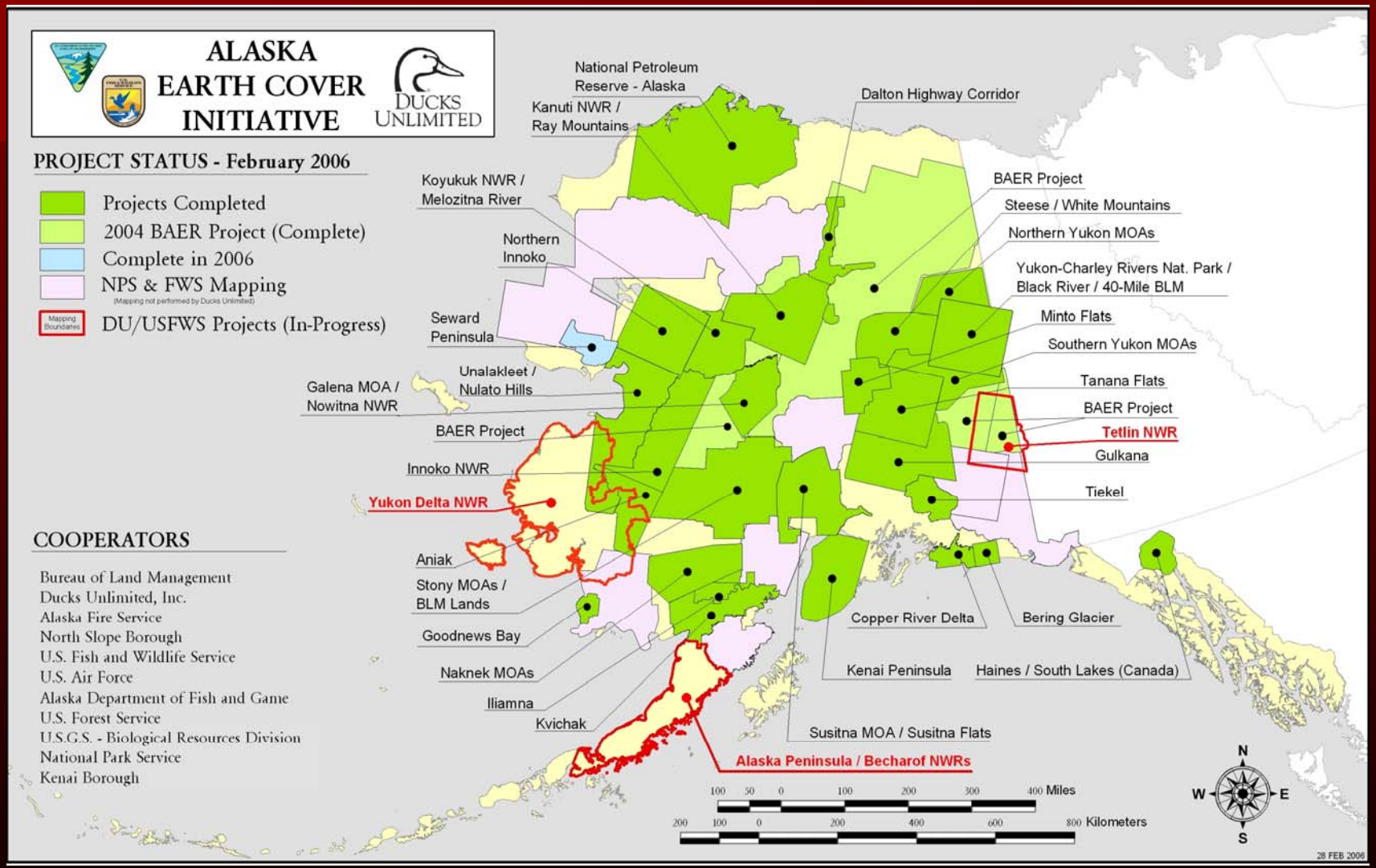


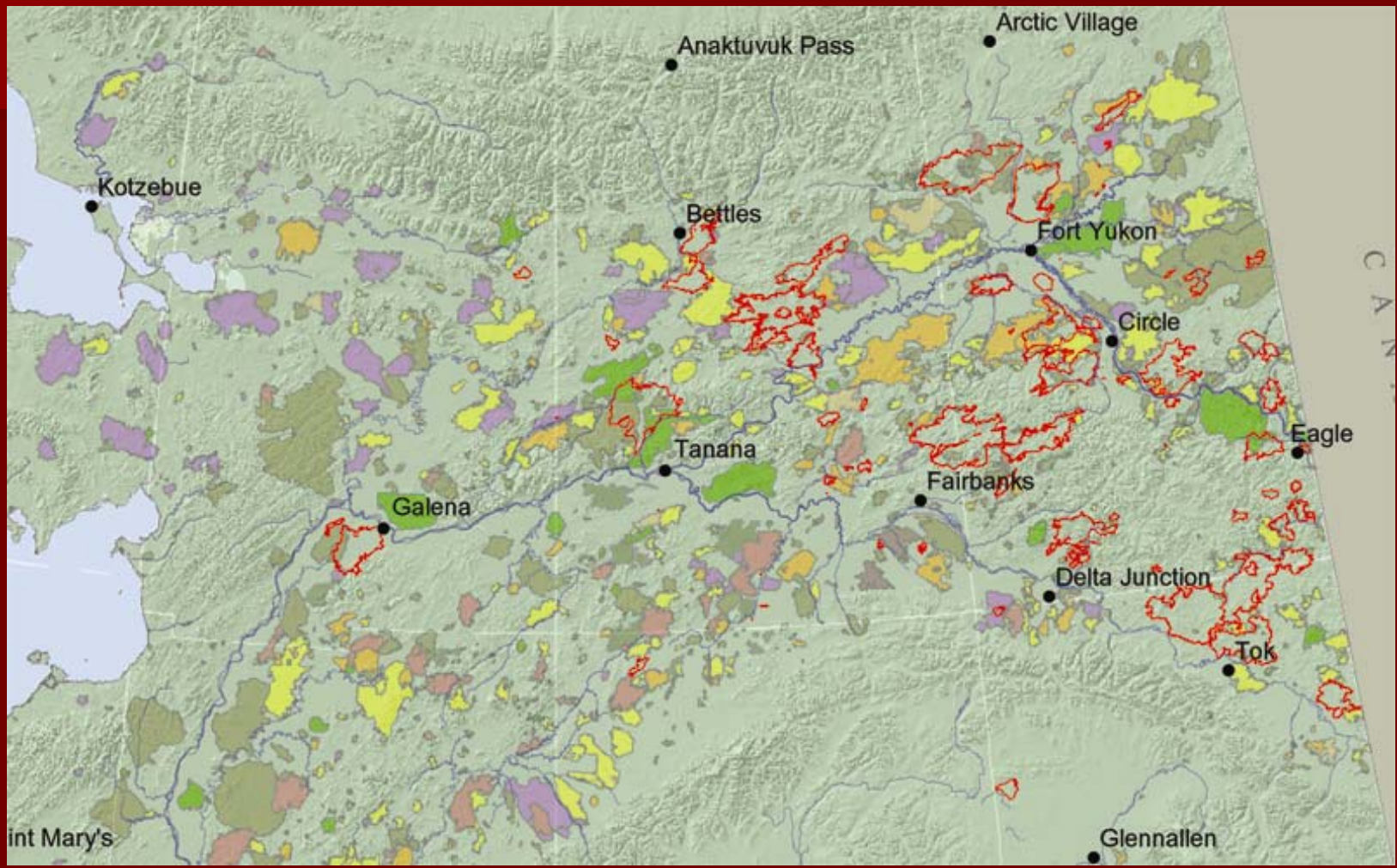
ALASKA EARTH COVER INITIATIVE

ALASKA EARTH COVER INITIATIVE

2006 PROJECT STATUS

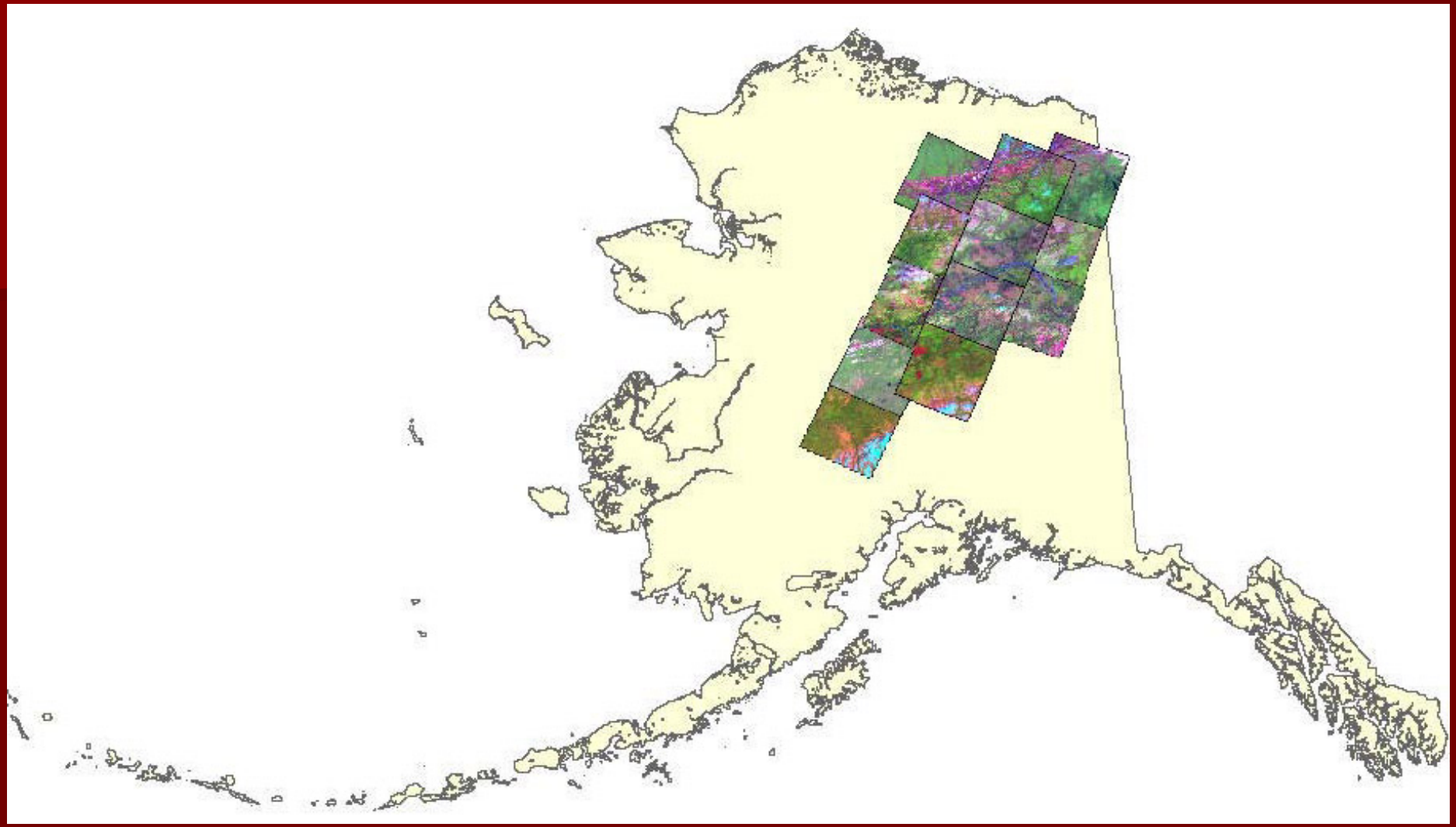


BAER Earth Cover Project



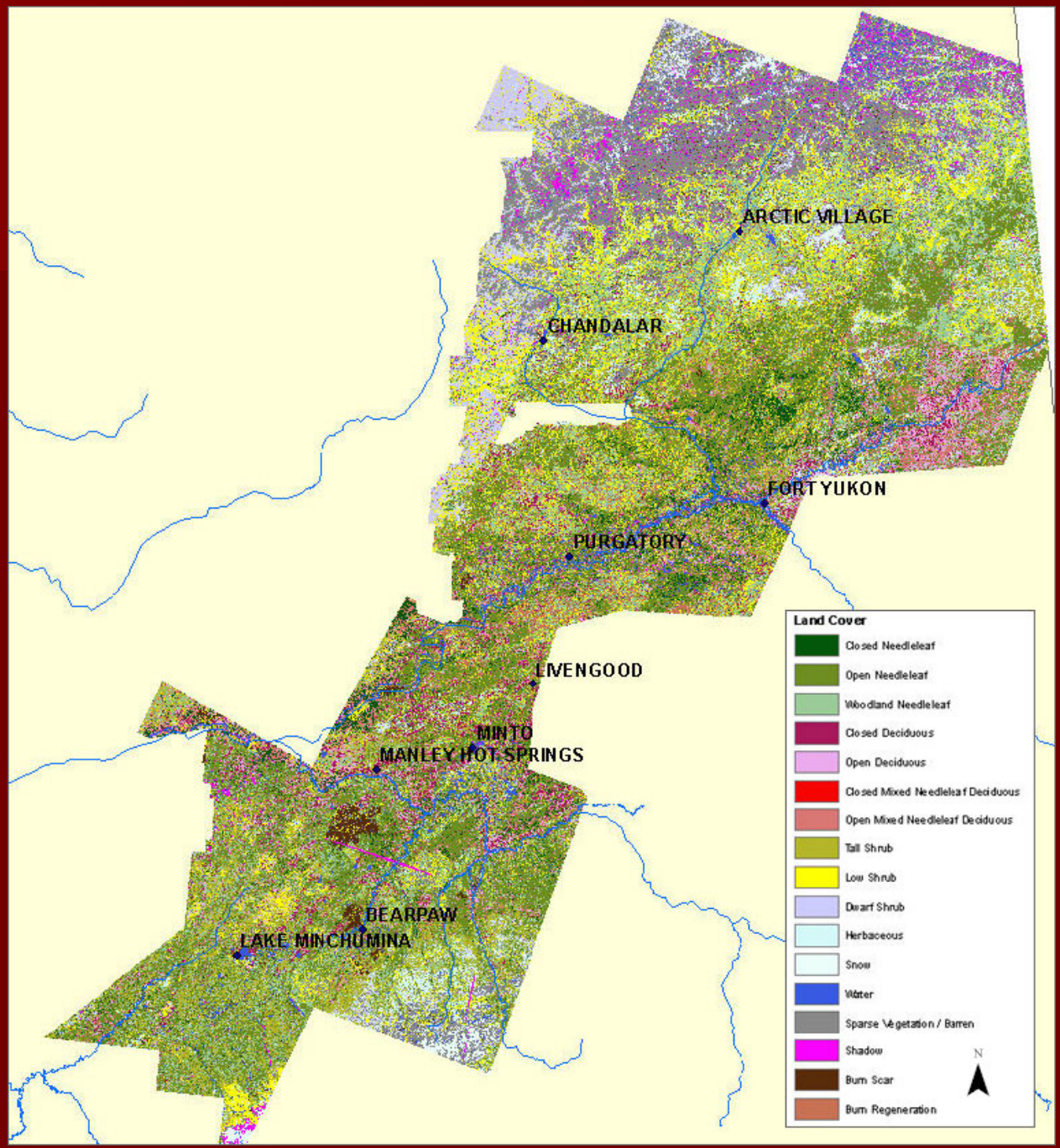
Fire History Map- 2004 fires in “RED”

ALASKA EARTH COVER INITIATIVE

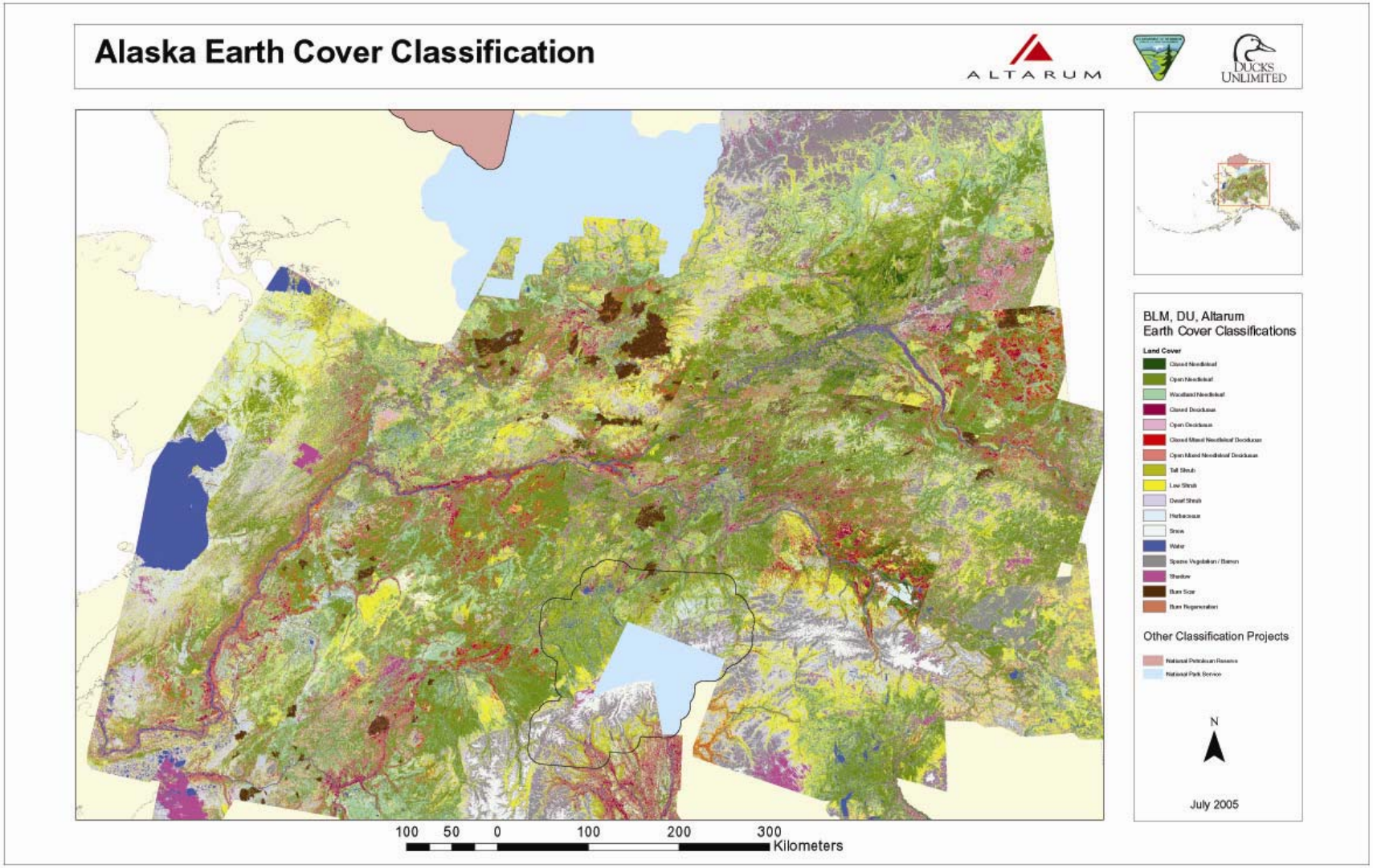


Satellite imagery used for the BAER mapping project

BAER
Project Area



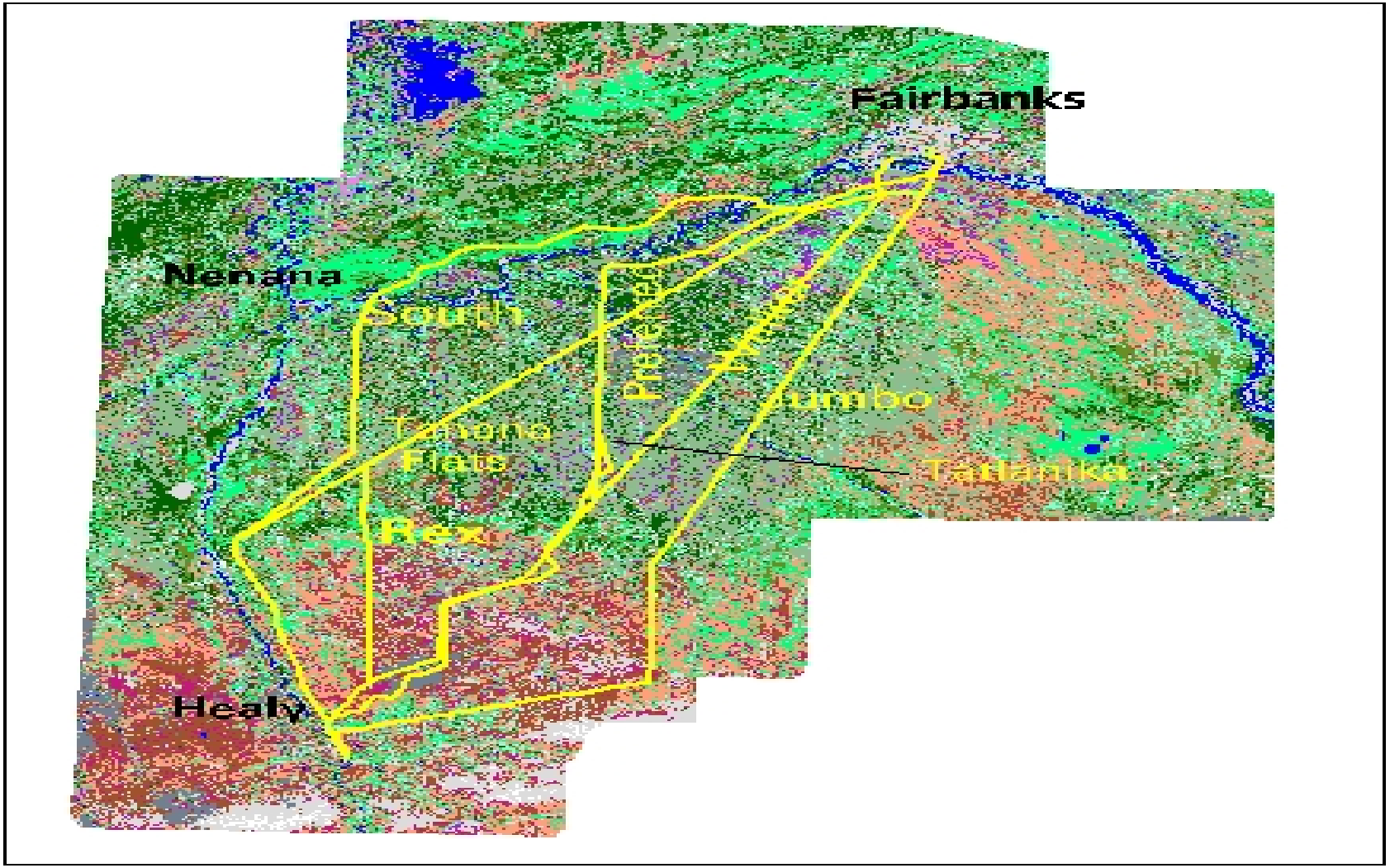
BAER Project Mosaic



Uses for Management

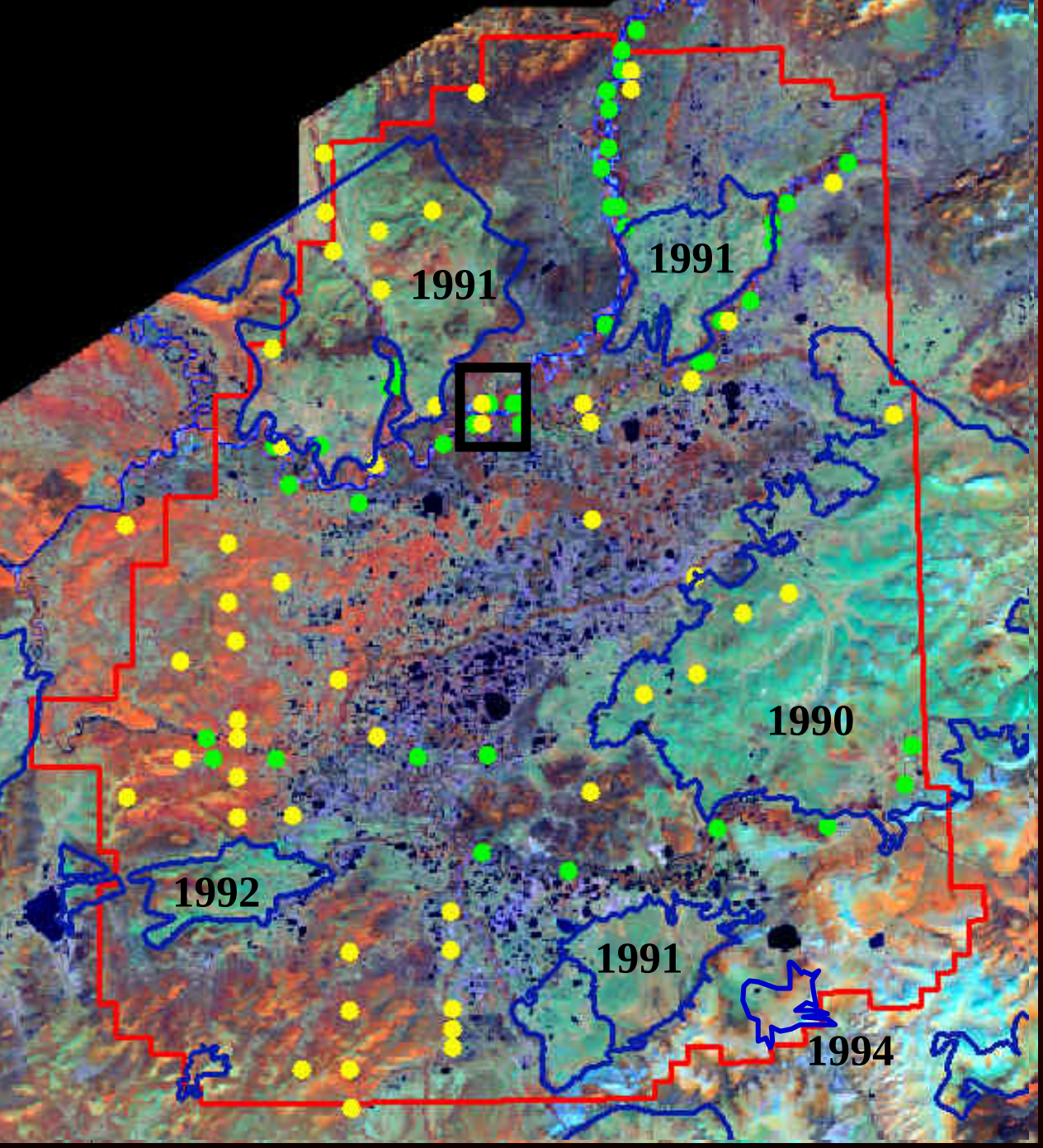
- Wildlife and Waterfowl Habitat Selection
- Habitat Modeling
- Forest Fire History / Fuels Modeling
- Change Detection
- Environmental Impact Statements/CCP
- Road/Pipeline/Utility Placement
- Successional Vegetation Changes
- LandFire
- FRCC

Minto Flats - Golden Valley Electric Association
Landcover Classification



Fire Fuels Modeling

- Direct crosswalk from Earth Cover classifications to the Canadian Forest Fire Behavior Prediction Model



Kanuti NWR

Moose Survey - 1999

LandSat TM Image
July 2, 1999

Fire Boundaries

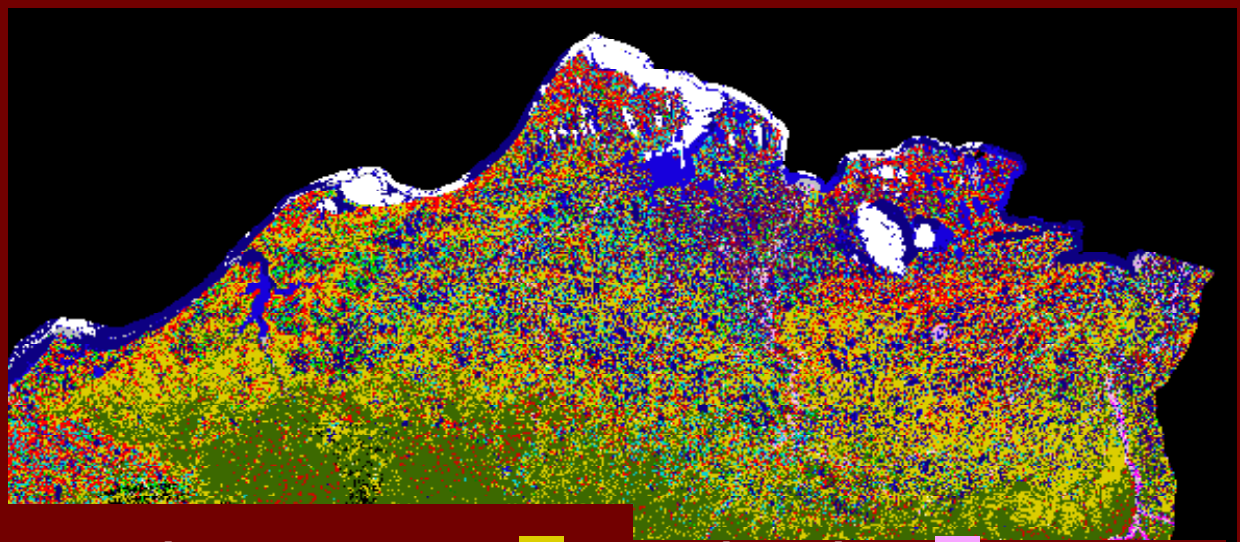
Refuge Boundary

River Survey

Transects

Digital Earth Cover

of the NPR-A Arctic Coastal Plain



- Carex aquatilis
- Arctophila fulva
- Flooded Tundra - LCP
- Flooded Tundra - Non-pattern
- Wet Tundra
- Sedge / Grass Meadow
- Tussock Tundra
- Moss / Lichen
- Dwarf Shrub
- Low Shrub
- Tall Shrub
- Dunes / Dry Sand
- Sparsely Vegetated
- Barren Ground / Other
- Clear Water
- Turbid Water
- Ice

Focal Species

***for* resource selection analyses**

Canada Goose

Brant

White-fronted Goose

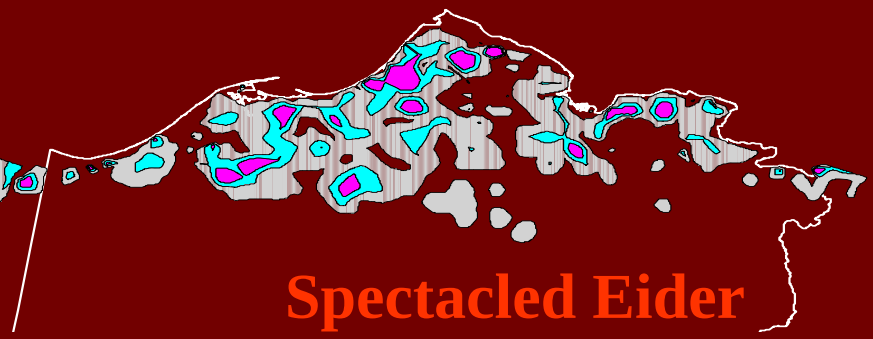
Oldsquaw

Steller's Eider

King Eider

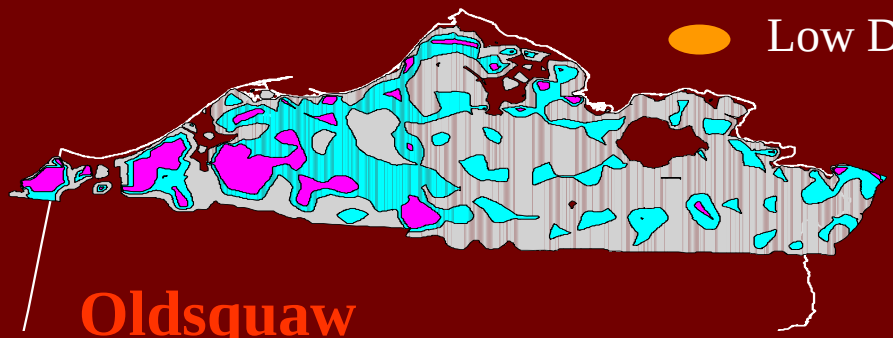
Waterfowl Densities

King Eider
n = 952

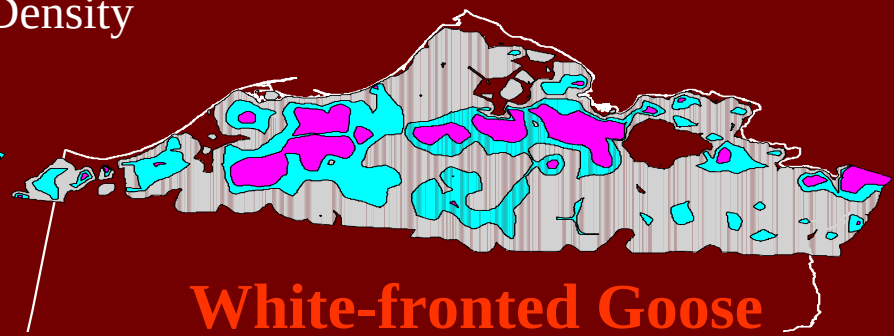


Spectacled Eider
n = 651

High Density
Medium Density
Low Density

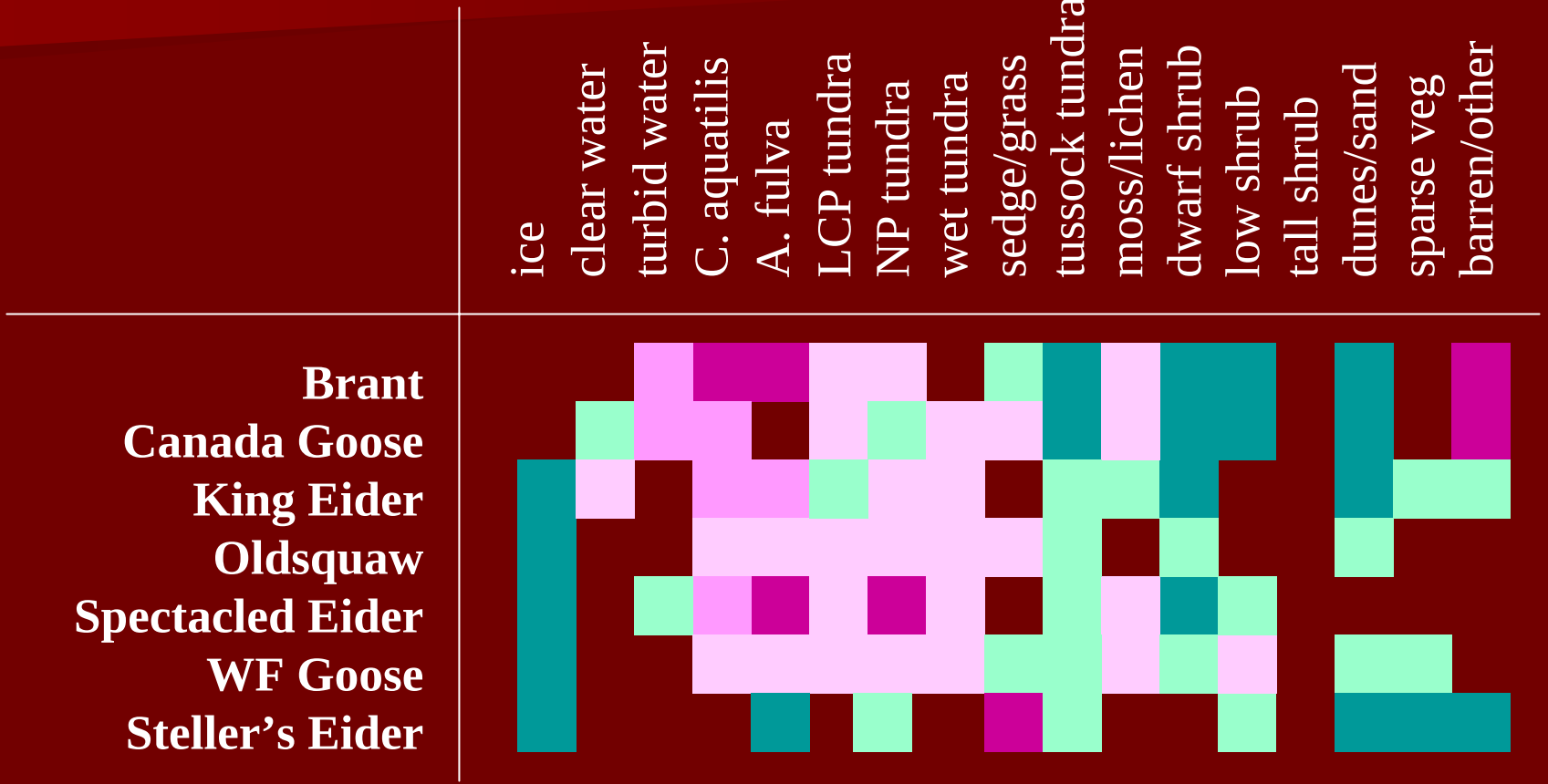


Oldsquaw
n = 3811



White-fronted Goose
n = 4595

Earth Cover Selection Patterns



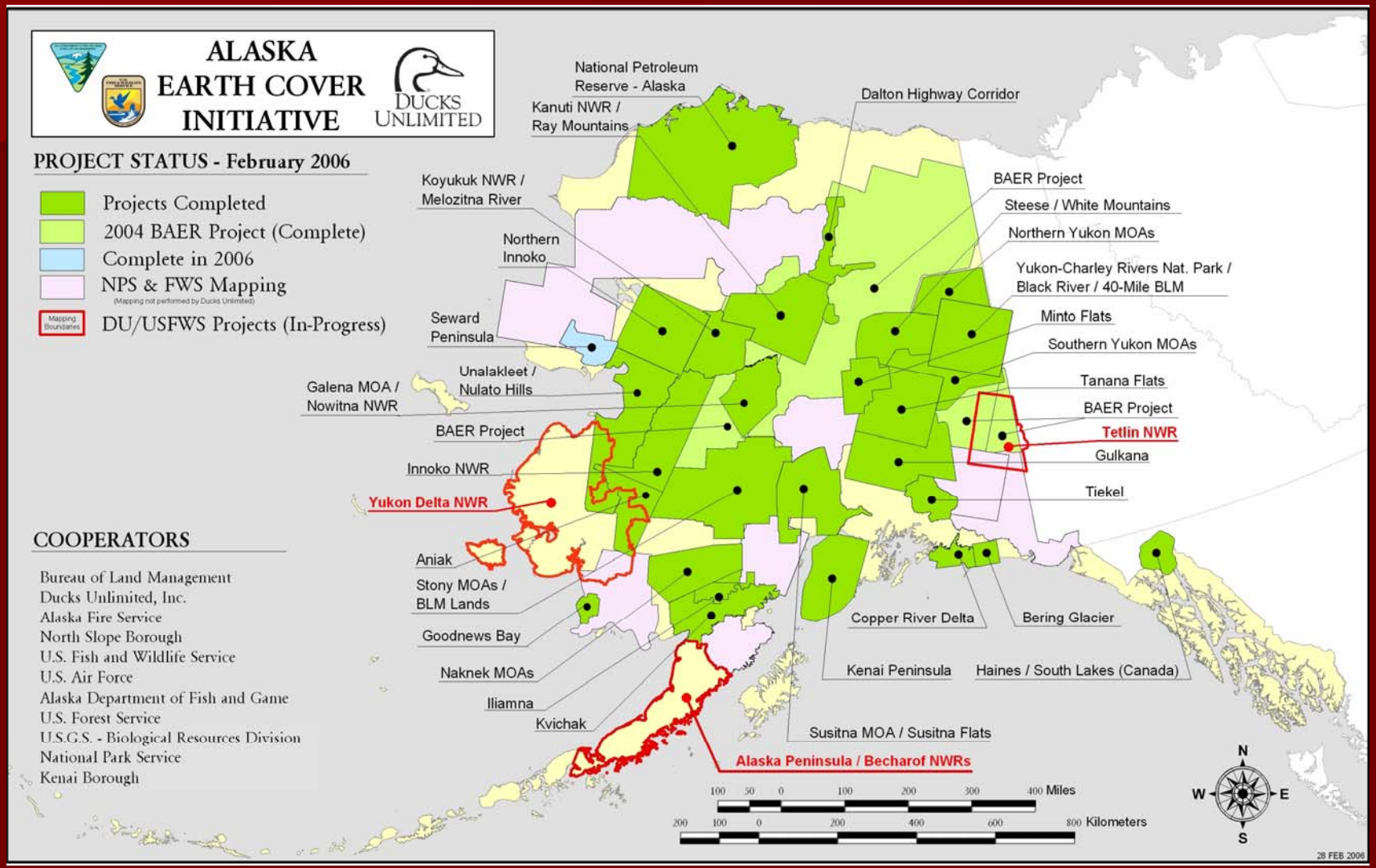
SELECTION KEY

strongly for **moderately for** **for** **against** **moderately against**

Summary
Values of Satellite Mapping

- Large-scale perspective and efficient value ($.05-.08/acre)
- Earth cover data and protocol allows for repetition and change detection analyses over time
- Models can be refined and different scenarios tested, especially for monitoring and evaluation
- Field data collection contributes to Highly Accurate Final Products
- Continued work contributes to State Wide Earth Cover Data Set.

2006 PROJECT STATUS



Many thanks to our cooperators

DUCKS UNLIMITED

USGS
science for a changing world